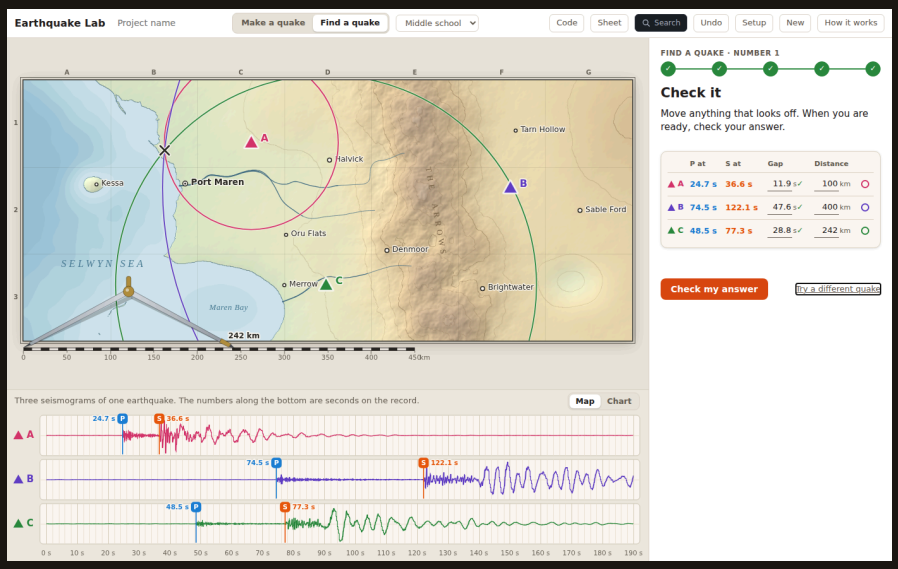
mytekDev

Earthquake Lab: Find the Epicenter

Grades 6-8 · 45 minutes

Earth science



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a station table
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grade 4 and in high school earth science
- Standards: NGSS

Earthquake Lab: Find the Epicenter

Grades 6-8 · 45 minutes · Earth science

A quake is hidden, and three seismograms are all students get. They mark where the P and S waves arrive, subtract to get the gap, read each distance off a travel-time chart, and set a compass to draw a circle round each station. Where the three circles cross is the epicenter. The app checks the answer and says which step went wrong, and every student gets their own quake.

At a glance

ESSENTIAL QUESTION

Scientists cannot see where an earthquake started. How do three seismograms find it?

OBJECTIVES

Students will be able to:

- mark the P and S arrivals on a seismogram and calculate the S-P gap
- read a distance from a travel-time chart
- use three distances to find an epicenter by drawing circles
- explain why one or two stations are not enough

VOCABULARY

Epicenter, Focus, Travel-time chart, Triangulation, Seismograph station

STANDARDS

MS-ESS3-2

TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/earthquakelab?lesson=find-the-epicenter&ref=tpt-earthquakelab-2 once on a student computer to check that your school's filter allows the app. Find one quake yourself, about fifteen minutes: press Find a quake, place the six flags, type the gaps, read the distances on the chart, draw the three circles, click where they cross, and press Check my answer. Then press Find another.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up: a friend 5 km away, direction unknown. Draw where they could be.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app. Press Find a quake. Mark the P and S on one strip, aloud: the first wiggle after the quiet, then the jump. Type the gap. Open the chart and slide the paper until the top mark touches the S line. Show Three circles. > **It's working when:** A loupe magnifies the strip beside the flag you hold, and the arrow keys nudge the last flag a tenth of a second. The app never snaps a flag into place.	Watch, and fill in the vocabulary on the worksheet.
12 to 22	**Guided practice (We do)** The first steps together	Students open the link or scan the QR code. A short guide walks them through Find a quake, the flags and the gaps. Every student has a different quake, so check the method, not the numbers. > **Watch for:** Students who put the S flag on the big, slow waves at the end. Those are surface waves; the S wave is the first jump before them. The check names this mistake.	Fill in the station table: P at, S at, gap.
22 to 38	**Independent practice (You do)** Find it	Students read their three distances, draw the circles, click where they cross and check. A miss lists what to look at again; Fix my work and check again lets them correct it. Those who finish press Find another. Walk the room with the What to look for questions. > **If they ask:** "Before you draw the third circle: where could the quake be with only two?" Two circles	Finish the station table with distances, find the epicenter, and record how far off the check said it was.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Take reasons for the triangle: small reading errors, and the quake starting underground. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a fifteen-minute walkthrough

Open mytekdev.com/try/earthquakelab?lesson=find-the-epicenter&ref=tpt-earthquakelab-2. A short guide opens over the app. Press `Find a quake`: a quake breaks where nobody can see it, the three strips fill, and the right side shows five steps.

1. **Mark the arrivals.** Drag the P flag to where the quiet line first wiggles and the S flag to where the wiggles jump. A loupe magnifies the strip; the arrow keys nudge the last flag.

2. **Find the gap.** Type S minus P for each station. The app checks the subtraction and ticks it.
3. **Read the distance.** Click a distance blank: the chart opens. Move the paper along the P line until its top mark touches the S line, and type the distance under its edge.
4. **Draw the circles.** Drag the compass pencil along the ruler under the map to a distance, click that station, and swing the pencil round. Three times.
5. **Mark and check.** Click where the circles cross and press `Check my answer`. The star appears with how far off you were, and if you missed, which step to look at again.

> Setup in the header decides whether every student gets their own quake (the default) or everyone shares the same ones, and prints an answer key.

Background for the teacher

A seismograph station knows how far away a quake was from its S-P gap, but not which way. All it can say is that the quake is somewhere on a circle around it. A second station's circle crosses the first in two places; a third passes through only one of them. That is the epicenter, the point on the map above the focus.

Real circles rarely meet at one point. Readings are a little off, and the waves started underground, so each distance is really to the focus, a little longer than along the map. Students click the middle of the small triangle. The map is made up, and so is every quake on it. The waves travel at 6 and 3.5 kilometers a second in straight lines; in the real Earth they speed up with depth and bend, so the 8 km rule works best within about 200 kilometers.

The check names the classic mistakes from the student's own numbers: the S flag on the surface waves, an arrival time written as the gap, the chart read along one line only, a compass set to another station's distance, a circle drawn wrong on the ruler.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- How did you decide where the S wave starts?
- Why does the paper have to touch both lines on the chart?
- With only station A's circle, where could the quake be?
- With two circles, how many places are possible?
- Why did your circles leave a triangle and not a point?

> The fourth question is the real test: a student who says two places, and that the third circle picks one, has triangulation.

Cross-curricular extensions

- Math: GPS finds a phone the same way, with distances to satellites. Why does it need a fourth one in three dimensions?
- Geography: look up the most recent earthquake on the USGS map and how many stations recorded it.
- English: write the check's note for a mistake you made, in your own words, as advice to a classmate.
- Technology: in Code, write the rule that turns a gap into a distance and let the lab try it on forty quakes.

Vocabulary

Epicenter	The point on the map straight above where an earthquake starts.
Focus	The place underground where the fault breaks.
Travel-time chart	A graph of how long each wave takes to travel each distance.
Triangulation	Finding a place from its distances to three known points.
Seismograph station	A place with an instrument that records the ground shaking.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the screen as you say each word: the rings, the flags and the circles carry the meaning.
- Pair each learner with a partner; the steps on the right name each step and tick it off when done.
- Accept the station table with numbers only.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students, one marking flags and one filling in the table, then swap for the circles.
- Zoom the browser to 125%; the arrow keys move a flag a tenth of a second without dragging.
- Allow the 8 km rule (gap times 8) in place of reading the chart, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "The quake was ___ km from station A because its gap was ___ seconds."
- A check-in after the gaps: every student has three ticked gaps before opening the chart.
- Do the chart for one station together on the board.

STUDENTS READY FOR MORE

- Find a second quake without the guide and beat your first distance off.
- Hide a quake for someone else to find: make one in Make a quake and press Hide this one for a friend.
- Pick High school: work out when the quake happened from one station's P time and the chart.

Adapting for other grades

Younger students: Grade 4 does not find hidden quakes: the 4th grade level only makes them. Use the first lesson in this series instead, or do this one as a whole class with the teacher at the board.

Older students: In high school, pick High school: students also work out when the quake happened (right within 1.5 seconds) and its magnitude from the tallest swing on Richter's nomogram (right within 0.3).

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/earthquakelab?lesson=find-the-epicenter

Essential question: Scientists cannot see where an earthquake started. How do three seismograms find it?

Warm-up: A friend is 5 km away, direction unknown. Where could they be? _____

1. **Vocabulary.** Epicenter, focus, travel-time chart, triangulation, seismograph station: write each in your own words.

2. **The station table.** For stations A, B and C: P at _____ s; S at _____ s; gap _____ s; distance _____ km. Then: how far off was your epicenter? _____ km.

1. Why do you need three stations? What would one tell you? Two?

2. Your circles left a small triangle. Give two reasons.

Earthquake Lab: Find the Epicenter

Exit ticket

Name: _____

1. One station's S-P gap tells you (A) the direction of the quake (B) the distance to the quake (C) the size of the quake

2. Two stations' circles cross in (A) one place (B) two places (C) no places

3. Explain why the epicenter is where three circles cross.

Earthquake Lab: Find the Epicenter

Exit ticket

Name: _____

1. One station's S-P gap tells you (A) the direction of the quake (B) the distance to the quake (C) the size of the quake

2. Two stations' circles cross in (A) one place (B) two places (C) no places

3. Explain why the epicenter is where three circles cross.

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	The gap grows with distance; it says nothing about direction.
2	B	Two circles usually cross twice, so a third station is needed.
3	It is the only place the right distance from all three	Each circle is every place at that station's distance; only the crossing point is on all three. Saying only that the circles cross there is half.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The station table	P, S, gap and distance for all three stations, gaps correct, distances within the chart's reading.	All three stations with P, S and gap, and distances.	Some stations filled in.	No table.
Finding the epicenter	A good find (within 15 km), or a miss corrected using the check's note.	A find within 35 km.	Circles drawn but no epicenter marked, or a miss not corrected.	No circles.
Explaining the method	Explains why three stations are needed and gives two reasons the circles leave a triangle.	Explains why three stations are needed.	Describes the steps without why.	No explanation.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for MS-ESS3-2: students analyze seismic data to locate a natural hazard. No NGSS performance expectation names locating an epicenter; it is the classroom's way of doing this data work.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**MS-ESS3-2**	6-8	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	Students turn three seismograms into the location of an earthquake, data the clarification names.

Checked November 2026 against: NGSS MS-ESS3-2, Earth and Human Activity.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/earthquake-lab/lessons/find-the-epicenter/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

Terms of use

Thank you for downloading this lesson. The plan, the handouts and the art were made by mytekDev.

You may:

- print and copy it for your students
- change it for your own classes
- post it on your class website or learning management system
- share this file with other teachers, whole and unchanged, with this page included

You may not:

- sell it, or put it in a product you sell
- share a changed copy
- claim it as your own

The app this lesson uses is free and runs in the browser. Students need no account. It is at mytekdev.com.

Questions, or found a mistake? Ask on the Teachers Pay Teachers Q&A for this resource, or write to us at mytekdev.com/contact.

© 2026 mytekDev. All rights reserved.